

Answer on Question 49993, Physics, Mechanics — Kinematics — Dynamics A hammer of mass 3000 kg falls under gravity from a height of 20m on to a pile of mass 2000 kg. If the pile moves in to the ground 12 cm due to the blow, calculate the initial velocity of the pile assuming that the hammer and the pile are in contact after the collision also calculate the resistance force offered by ground.

Solution

We will use energy conservation law here. Potential energy of hammer mgh at the beginning is equal to kinetic energy of both

$$m_hgh = (m_p + m_h)v^2/2$$

Initial velocity of pile then is

$$v = \sqrt{\frac{2m_hgh}{m_p + m_h}} = \sqrt{\frac{2 \cdot 3000 \cdot 9.8 \cdot 20}{3000 + 2000}} \approx 15.3 \text{ m/s}$$

All this energy is used to do the work during penetrating the ground, hence

$$F\Delta l = m_hgh$$

$$F = \frac{m_hgh}{\Delta l} = \frac{3000 \cdot 9.8 \cdot 20}{0.12} \approx 4.9 \cdot 10^6 \text{ N}$$